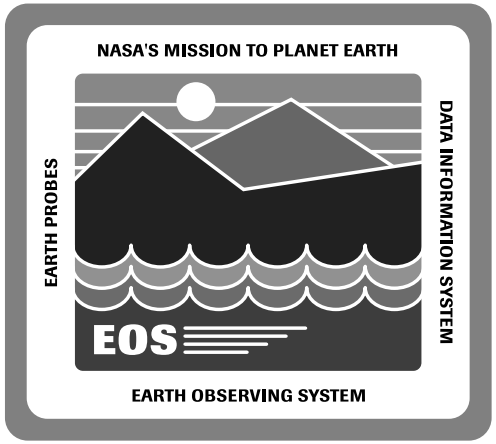

Human-Machine Interface (HMI) Methodology: GUI Development and Assessment

John Lowry **Virginia Rappold**

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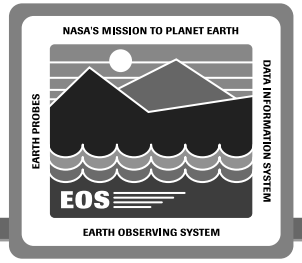
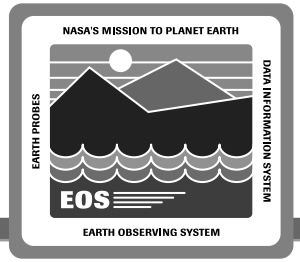
ECS Release A SDPS/CSMS Critical Design Review
16 August 1995

Goals of the ECS Human Factors Effort



- **Develop ECS GUIs that:**
  - **Reduce potential for operator/user performance errors**
  - **Enhance operator/user productivity and acceptance**
  - **Increase software usability**
- **Ensure effective integration of custom GUIs with COTS and HTML GUIs, with an initial focus on custom GUIs**
- **Focus across entire ECS development effort**

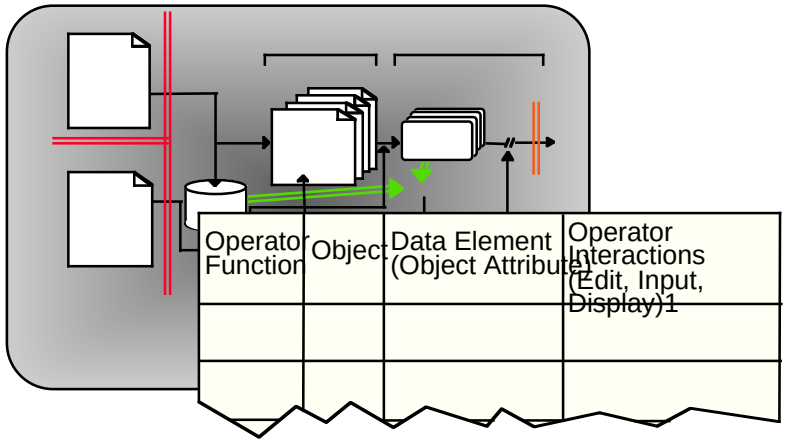
HMI Methodology



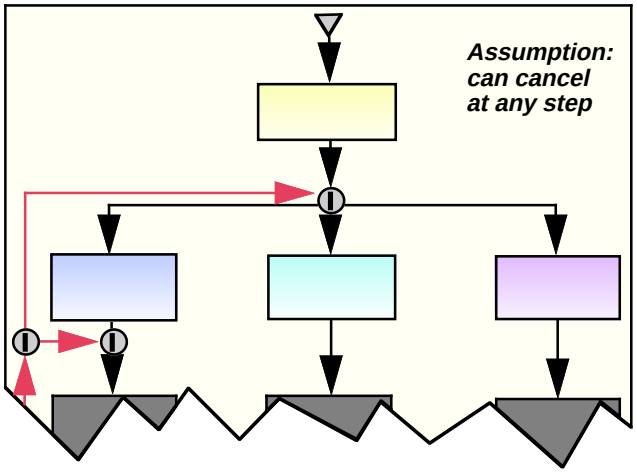
- **Create GUI development process**
- **Revise and extend *ECS User Interface Style Guide (Version 5)***
- **Conduct GUI developer's workshop**
- **Perform human factors assessments**
- **Analyze COTS and HTML GUI integration**

Overview of GUI Development Process

Step 1 - Data Input

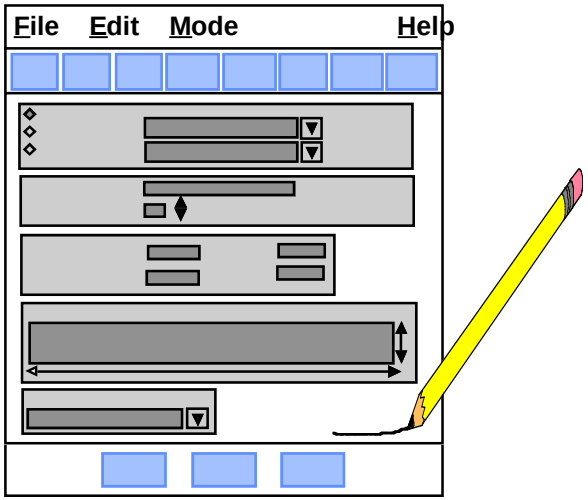


Step 2 - Workflow Analysis

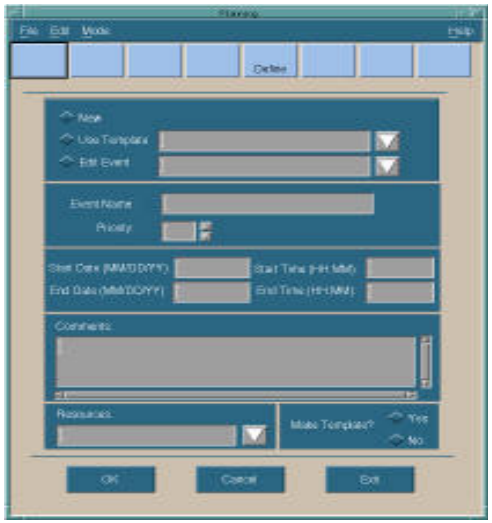


Evaluate at any Step

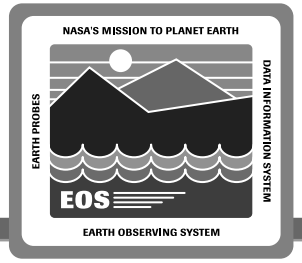
Step 3 - Screen Diagram



Step 4 - Develop GUI Screen

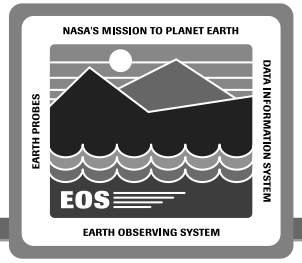


ECS User Interface Style Guide



- **Most recent version now available for review on EDHS (via "Latest Postings" until 9/15/95)**
  - **Human factors guidelines for ECS desktop and workbench**
  - **Guidelines for custom-developed applications (Motif)**
  - **Guidelines for COTS software applications**
  - **Guidelines for HTML-based software applications**

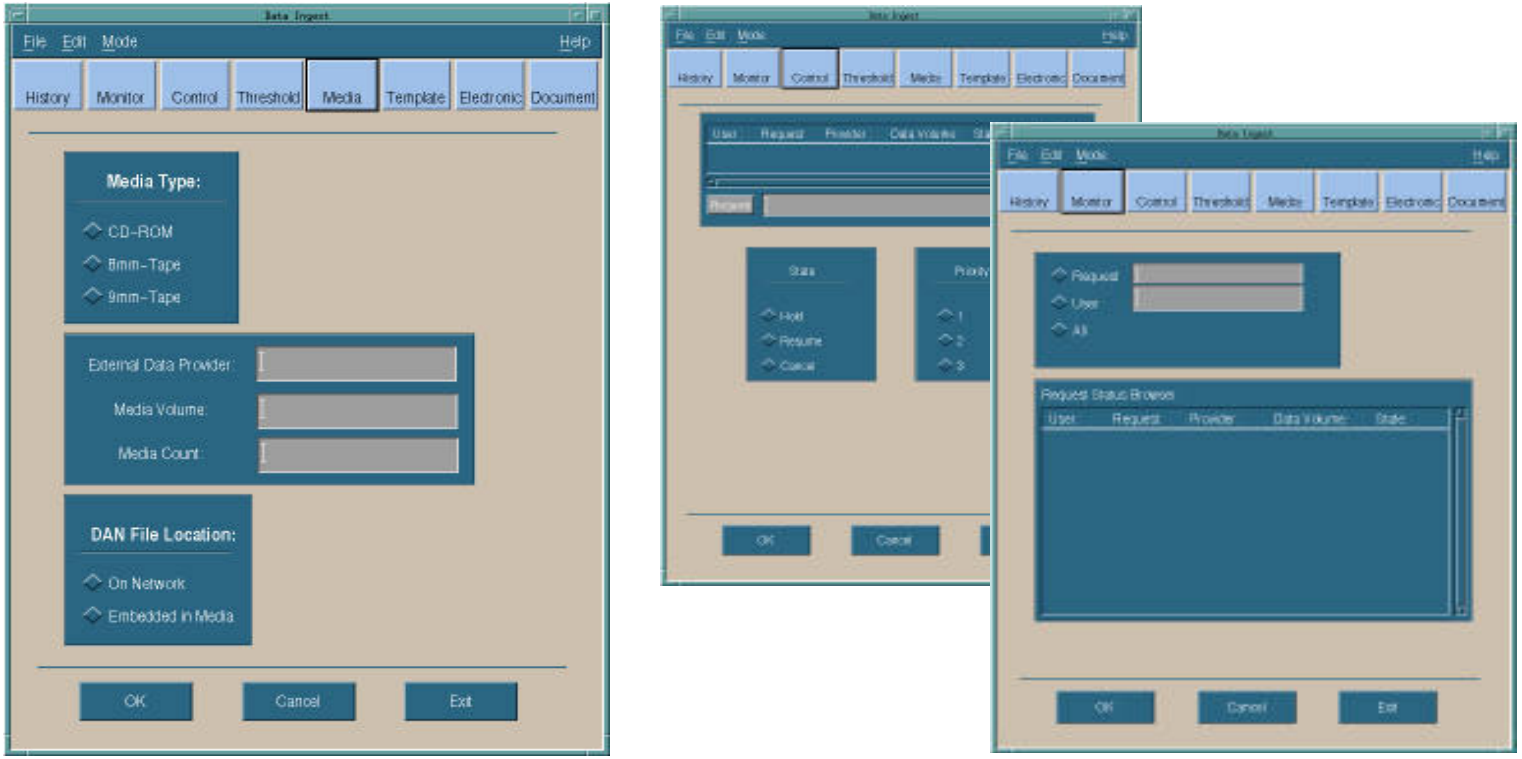
GUI Developer's Workshop



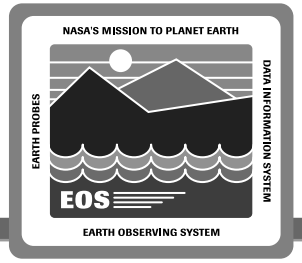
- **Educate developers on GUI development process**
- **Review *ECS User Interface Style Guide***
- **Hands-on instruction in using Builder Xcessory and ECS screen templates**
- **Distribute GUI development materials and tools to aid GUI design**

GUI Integration Concept

- **Use iconic toolbar and multiple ‘container’ widgets on Motif MainWindow**
- **Focuses operator on information required to accomplish task**
- **Constrains screen information density to 25%**
- **Shares the display ‘real estate’ with other applications**

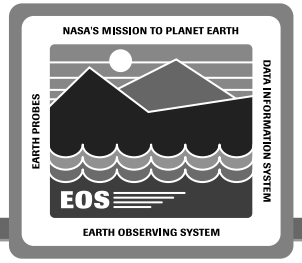


Human Factors Analysis of COTS GUI Integration



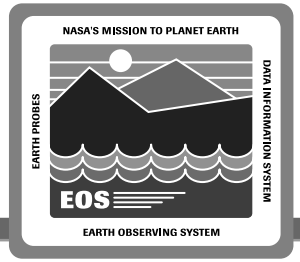
- **Overview of our concerns: 'Hodgepodge' of GUIs**
- **Challenge: Design/Tailor custom-developed, COTS, and HTML GUIs to produce an effective integration of ECS software**
- **Response: Conduct a three-step analysis of COTS integration**

Three-Step Analysis of COTS GUI Integration



- **Identify the variety of interfaces for each ECS operator/user role**

Operator/User Roles and Software



GUI Environments

Operator/User Roles

Open View	Remedy	AutoSys	...	Motif	HTML
	X		...	X	
X			...		X

- System Administrator/ Computer Operator
- Operations Supervisor
- Production Planner/ Scheduler
- Archive Manager
- ⋮
- Science Users
- Non-Science Users

Sample Format

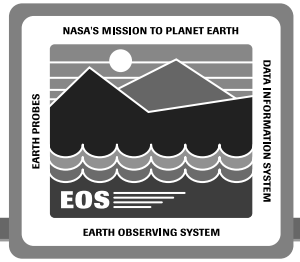
Operator Roles and Software

Operator/User Roles

GUI Environments

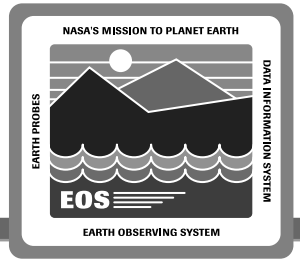
Operator/User Roles	Open View	Remedy	AutoSys	AutoSys	AutoSys	Motif	HTML
System Administrator/ Operator	x	x	x		x	x	x	x
Operations Supervisor	x	x	x		x	x	x	x
Production Planner/ Scheduler	x			x	x	x	x	
Archive Manager					x	x	x	x
Science Users	x				x		x	x
Non-Science Users							x	x
Archive Manager	x	x	x	x		x	x	
Non-Science Users		x		x	x	x	x	x
Production Planner/ Scheduler	x		x	x		x	x	x
Non-Science Users	x	x		x	x		x	x

Three-Step Analysis of COTS GUI Integration (cont'd)



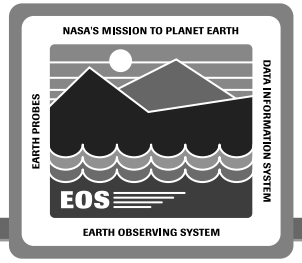
- **Identify the variety of interfaces for each ECS operator/user role**
- **Assess the human factors aspects of COTS GUIs**
  - **Focus attention on rows with "collisions"**
  - **Identify potential for:**
    - » **induced errors**
    - » **reduction in productivity**
- **Prepare a plan of interventions relative to "Cost/ Benefit"**
  - **For collisions with maximum effect**
  - **For rows with large payoff**

Potential Interventions to Address COTS GUI Challenges



- **Potential human factors interventions**
  - **Revise the workflows**
  - **Train operators/users to expert level of performance**
  - **Develop job aids**
  - **Tailor COTS system defaults and user preferences to *ECS User Interface Style Guide* or to minimize induced error/maximize productivity**
  - **Tailor operator roles and responsibilities**
  - **Encapsulate one or more COTS GUIs**
  - **Customize workbench**
    -
    -
    -

ECS User Interface Assessment

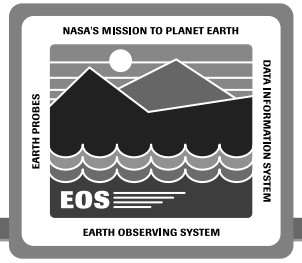


- **Purpose: Conduct independent human factors assessment of ECS user interface**
- **Assessment activities:**
  - **Review GUI development process**
  - **Assess *ECS User Interface Style Guide***
  - **Prepare Human Factors Assessment Checklist**

ECS Interface Checklist Sample

1 = Always 2 = Mostly/Usually 3 = Sometimes 4 = Never 5 = Not Applicable	1	2	3	4	5	Com
Screen Design Is the data consistently grouped in some logical sequence apparent to the user (e.g. sequence of use; alphabetically, chronologically)? NASA 3.3.1.8						
Are multiple pages used for displays with too much data? NASA 3.3.1.4						
Is each multiple page labeled to show its relation to other pages? NASA 3.3.1.3						
Are different elements in the display format easily distinguished (e.g. by color, coding, shading)? NASA 3.3.1.1						

ECS User Interface Assessment (cont'd)



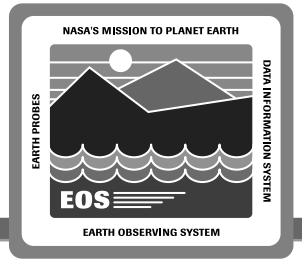
- **Purpose: Conduct independent human factors assessment of ECS user interface**
- **Assessment activities:**
  - **Review GUI development process**
  - **Assess *ECS User Interface Style Guide***
  - **Prepare Human Factors Assessment Checklist**
  - **Assess ECS GUI screens**
  - **Identify/Track Human Engineering Discrepancies (HEDs)**

HED Example

Interface Discrepancy	Criticality	Recommendation	Status
Closing subordinate window erases information on main window.	Critical	Modify main window function to prevent data erasure.	Corrected.
Closing main window does not automatically close subordinates.	Important	Use warning to inform user of possible data loss.	Problem partially corrected.
Subordinate windows appear under main window.	Advisory Notice	Use message to inform user that active window is hidden.	Corrected.

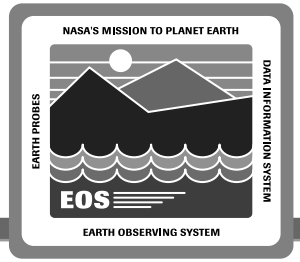
Critical	Action or function results in or leads to loss of data and interrupts use of system.
Important	Action or function may contribute to loss of data and impedes or slows use of system.
Advisory Notice	Action or function does not result in loss of data but slows system use.

Status of GUI Human Factors Assessments



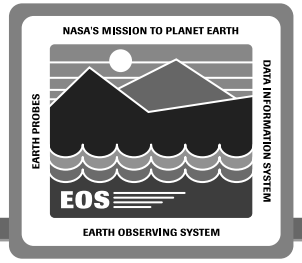
- **Current assessment limited to methodology and Style Guide**
  - **Review of GUI development process: Complete**
  - **Review of *ECS User Interface Style Guide*: Complete**
  - **Human Factors Assessment Checklist: Complete**
  - **Review of GUI screens: Initiated**

Results of Current Assessments



- **Results of GUI Development Process review**
- **Results of *ECS User Interface Style Guide* review**
  - **Style Guide is comprehensive**
  - **Expand guidelines for desktop/workbench**
  - **Expand guidelines for map/situation displays, form filling displays, resiliency/robustness of GUI**
  - **Provide subject index to Style Guide**
- **Human Factors Assessment Checklist**

Near-Term Actions in Human Factors Assessments



- **Track revisions of *ECS User Interface Style Guide***
- **Assess GUI development screens and templates**
- **Prepare Human Engineering Discrepancy (HED) list**
- **Assess COTS and HTML GUI integration**
- **Evaluate GUI screens prior to production**